

**AMENDMENTS TO THE CLAIMS**

This listing of claims will replace all prior versions and listings of claims in the application:

**Listing of Claims**

1-16. (canceled)

17. (currently amended) A multi-compartment microfluidic device for enabling fluidic isolation among interconnected compartments within the device comprising:

a substrate coupled with an optically transparent ~~housing device~~;

said optically transparent ~~housing device~~ comprising a first microfluidic region having a first plurality of entry reservoirs for accepting or extracting a first volume of fluid;

said optically transparent ~~housing device~~ further comprising a second microfluidic region, said second microfluidic region having a second plurality of entry reservoirs for accepting or extracting a second volume of fluid that is less than said first volume of fluid to create hydrostatic pressure;

a barrier region that couples said first microfluidic region with said second microfluidic region in a way that enables a biological specimen to simultaneously extend across said first microfluidic region, said barrier region and said second microfluidic region; and,

said barrier region comprising a plurality of microgrooves having a width and height that enables said second volume of fluid to be fluidically isolated from said first volume of fluid via said hydrostatic pressure maintained via said at least one embedded microgroove wherein said first microfluidic region, said second microfluidic region, said first plurality of entry reservoirs, said second plurality of entry reservoirs and said barrier region are fabricated into said optically transparent device.

18. (previously presented) The multi-compartment microfluidic device of claim 17 wherein said first microfluidic region and said second microfluidic region are disposed parallel to one another and coupled with said barrier region.

19-20. (canceled)

21. (previously presented) The multi-compartment microfluidic device of claim 17 wherein said barrier region comprises a length of not less than 50  $\mu\text{m}$ .

22. (previously presented) The multi-compartment device of claim 17 wherein at least one of said plurality of microgrooves comprises dimensions less than 10  $\mu\text{m}$  in height.

23. (previously presented) The multi-compartment microfluidic device of claim 17 wherein said biological specimen comprises a cellular structure.

24. (previously presented) The multi-compartment microfluidic device of claim 23 wherein said first volume of fluid is applied to a first somal domain of said cellular structure and said second volume of fluid is applied to a cytoplasmic domain of said cellular structure.

25. (previously presented) The multi-compartment microfluidic device of claim 23 wherein said cellular structure comprises nerve cells.

26. (previously presented) The multi-compartment microfluidic device of claim 25 wherein said first volume of fluid is applied to a first somal domain of said nerve cell and said second volume of fluid is applied to an neuritic region of said nerve cell.

27. (previously presented) The multi-compartment microfluidic device of claim 26 wherein said first somal domain comprises a nerve cell body.

28. (previously presented) The multi-compartment microfluidic device of claim 26 wherein said neuritic region comprises an axonal domain.

29. (canceled)

30. (previously presented) The multi-compartment microfluidic device of claim 25 wherein synapses of said nerve cell are isolated in said second microfluidic region.

31-42. (canceled)

43. (new) A method for enabling fluidic isolation among interconnected compartments within a multi-compartment microfluidic device comprising:

coupling a substrate with an optically transparent device;

forming into said optically transparent device a first microfluidic region having a first plurality of entry reservoirs for accepting or extracting a first volume of fluid;

forming into said optically transparent device a second microfluidic region, said second microfluidic region having a second plurality of entry reservoirs for accepting or extracting a second volume of fluid that is less than said first volume of fluid to create hydrostatic pressure;

forming into said optically transparent device a barrier region that couples said first microfluidic region with said second microfluidic region in a way that enables a biological specimen to simultaneously extend across said first microfluidic region, said barrier region and said second microfluidic region; and,

isolating fluidically said first volume of fluid from said second volume of fluid using said barrier region comprising a plurality of microgrooves having a width and height that enables said second volume of fluid to be fluidically isolated from said first volume of fluid via said hydrostatic pressure maintained via said at least one embedded microgroove wherein said first microfluidic region, said second microfluidic region, said first plurality of entry reservoirs, said second plurality of entry reservoirs and said barrier region are fabricated into said optically transparent device.